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National Aeronautics and
Space Administration

Research Announcement

**Research Opportunities
in
Space Biological Sciences**

**NASA Specialized Center
of
Research and Training
(NSCORT)
for
Advanced Life Support**

2001

**A Research Announcement for the
Bioastronautics Research Division**

**Notices of Intent Due:
Proposals Due:**

**August 16, 2001
October 16, 2001**

**Announcement
NASA Specialized Center of
Research and Training for
Advanced Life Support**

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NASA Research Announcement

Research Opportunities in Space Biological Sciences

NASA Specialized Center of Research and Training (NSCORT) for Advanced Life Support

This National Aeronautics and Space Administration (NASA) Research Announcement (NRA) solicits proposals for a NASA Specialized Center of Research and Training (NSCORT) in support of the Advanced Life Support (ALS) Project within the Advanced Human Support Technology (AHST) Program. Proposals received outside the stated area of emphasis will be considered as non-responsive, unsolicited proposals and will be returned without review. However, NASA reserves the right to act in the best interests of the Federal Government in the matter of acceptance and evaluation of all proposals.

Proposals are solicited for an NSCORT whose research goals are relevant to the research goals of the ALS Project and are consistent with strategic goals of NASA's Office of Biological and Physical Research (OBPR). The NSCORT program is funded to conduct basic and applied ground-based research and analysis and **will not** support any space flight experimentation.

The mission of the OBPR is to use the synergy between biological, physical, and chemical research in space to acquire fundamental knowledge and generate information for space travel and Earth applications. Proposers are strongly encouraged to submit multidisciplinary research proposals consistent with the goals of the OBPR.

OBPR programs represent an opportunity for NASA to enhance and broaden public knowledge, understanding, and appreciation of biological and biomedical research, and the value of this research in the space environment. Individuals participating in NASA's Bioastronautics Research Division programs have a responsibility to foster the development of a scientifically informed public. Therefore, all participants in this NRA are strongly encouraged to promote general scientific literacy and public understanding of biological and biomedical sciences, the space environment, and OBPR programs through formal and informal education opportunities. Where appropriate, supported investigators will be required to produce, in collaboration with NASA, a plan for communicating their work to the public.

Proposals will be evaluated by independent peer review panels for overall scientific merit of the proposed work. A selection announcement will be made in January of 2002, pending budget availability. Funding of the selected NSCORT will begin in February or March 2002. NASA's obligation to make awards is contingent upon the receipt of proposals that the government determines are acceptable for award under this NRA and the availability of annually appropriated funds from which payment for award purposes can be made.

It is anticipated that there will be one award for approximately \$2,000,000 per year for five years with annual renewals for proposals submitted in response to this NRA. This award will be funded as a grant.

Information about the ALS Project, the AHST Program, and the preparation of proposals in response to this Announcement is included in the attached appendices, as follows:

- Appendix A provides background information about NSCORT Projects and other information that is applicable only to this Announcement.
- Appendix B contains detailed instructions that apply specifically to this NRA and includes the relevant application forms.
- Appendix C contains general instructions applicable to the preparation of proposals in response to NASA Research Announcements.

A notice of intent (NOI) to propose is requested by August 16, 2001, 4:30 PM Eastern Time (see Appendix A, section V.E.). While the submission of the NOI is not binding, proposers interested in this NRA are strongly encouraged to submit the NOI. For the benefit of all prospective proposers, NASA would post weekly updates and clarifications to questions with regard to the NRA on the Internet at the address below. For those who submit the NOI, these updates will be sent to you via E-mail. NOIs should be submitted via the World Wide Web (WWW) at:

http://research.hq.nasa.gov/code_u/nra/current/NRA-01-OBPR-04/index.html

If you do not have access to the World Wide Web, you may submit an NOI via E-mail to:

noi@hq.nasa.gov

The subject heading of the email message should read “NOI NRA 01-OBPR-04.” If you do not have access to E-mail, you may submit an NOI by U.S. Postal Service or commercial delivery to the address listed below for proposal submission.

Although NASA is working toward the capability to accept electronic proposals, proposals may not be submitted electronically in response to this NRA. ***Proposals must be received by October 16, 2001, 4:30 PM Eastern Time.*** Proposals and NOIs mailed through the U.S. Postal Service by express, first class, registered, or certified mail are to be sent to the following address:

NASA c/o NASA Peer Review Services (NPRS)
SUBJECT: NASA ALS NSCORT
500 E Street SW, Suite 200
Washington, DC 20024

Proposals and NOIs that are hand delivered or sent by commercial delivery or courier services are to be delivered to the above address between 8:00 AM and 4:30 PM EDT. The telephone number, (202) 479-9030, may be used when required for reference by delivery services. NPRS cannot receive deliveries on Saturdays, Sundays, or federal holidays. Upon receiving a proposal, NPRS will send a notification to the investigator confirming its arrival.

In order to be accepted as a complete submission, proposals **must include** completed copies of the appropriate forms provided in Appendix B. The following items apply only to this Announcement:

Solicitation Announcement Identifier:	NRA 01-OBPR-04
Number of Proposal Copies Required:	Original + 15 copies, double-sided pages highly encouraged
Notice of Intent Due:	August 16, 2001
Proposals Due:	October 16, 2001
Selecting Official:	Director Biastronautics Research Division Biological & Physical Research Enterprise

Additional Programmatic Information:

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Your interest and cooperation in participating in this effort are appreciated.

Kathie L. Olsen, Ph.D.
Acting Associate Administrator for
Office of Biological and Physical Research

National Aeronautics and Space Administration
Specialized Centers of Research and Training (NSCORT)

I. Introduction

The Bioastronautics Research Division of the Office of Biological and Physical Research (OBPR) seeks proposals for an Advanced Life Support NASA Specialized Center of Research and Training (NSCORT). The research goals for this NSCORT will be consistent with the research goals of the Advanced Life Support (ALS) Project in the Advanced Human Support Technology (AHST) Program. In the past 10 years, NASA has funded NSCORTs in the areas of Environmental Health, Gravitational Biology, Bioregenerative Life Support, Plant Biology, and Cellular and Molecular Biology. The currently solicited NSCORT will focus on Bioregenerative Life Support.

The purpose of this appendix is to describe the rationale and objectives of the NSCORT program, the types of awards to be made and the research focus of this solicitation.

II. Background and Objectives

The mission of the OBPR is to use the synergy between physical, chemical and biological research in space to acquire fundamental knowledge and generate applications for space travel and Earth applications. The OBPR Enterprise uses interdisciplinary approaches in fundamental and applied research to find new ways to withstand the space environment, in order to take advantage of the unique space environment for conducting research in science and engineering, and to generate new technology. However, a successful space program is founded upon solid ground-based research.

The basic and applied ground-based research performed in the AHST Program will enable the development of human support technologies that will help us to live and work effectively in space. The long-term goals of the AHST program are to:

- conduct research to enable safe and productive human habitation of space;
- use the space environment as a laboratory to test the fundamental principles of physics, chemistry and biology; and
- use space research opportunities to improve academic achievement and the quality of life on Earth.

The ALS Project in the AHST program works toward the attainment of these goals through research and technology development that aims at closed-loop life support. Recycling of air and water, food systems including crop production and processing of crops into storable items or

food dishes, and solid waste processing and resource recovery form the tenants of this life support system.

NSCORT Goals and Objectives:

The NSCORT program was established to advance fundamental knowledge in biological and biomedical sciences and technology with the ultimate application of this knowledge to enable human space flight and long-term planetary missions. The NSCORT program is expected to enhance NASA's base of scholarship, skills and performance in the space biological and biomedical sciences and related technological areas and also expand the pool of research scientists and engineers trained to meet the challenges ahead as we prepare for future human space exploration missions.

Specific goals of the NSCORT program are:

- to expand our understanding of specific scientific and technical challenges associated with biological and biomedical sciences;
- to provide substantial long-term funding to the research community in a manner that encourages the development of a stable base upon which problem-solving strategies of benefit to NASA and the public can be built;
- to involve a broad spectrum of high caliber students, research scientists and engineers in the activities of the NSCORT; and
- to facilitate the rapid transfer to NASA of knowledge gained and technology developed consistent with of its missions.

The research to be undertaken through the ALS Advanced Life Support NSCORT is anticipated to be a collaborative effort among investigators and institutions with complementary capabilities. This research will be primarily at the lower end (1-4) of the Technology Readiness Level (TRL) range. (Proposers should be aware of the concept of Technology Readiness Levels as it applies to their work - see Figure 1). Although this announcement solicits ground-based research that will ultimately have applications in the microgravity environment of space and the hypogravity environments (e.g., the Moon, Mars, an asteroid surface), no space flight experiments may be proposed in response to this announcement.

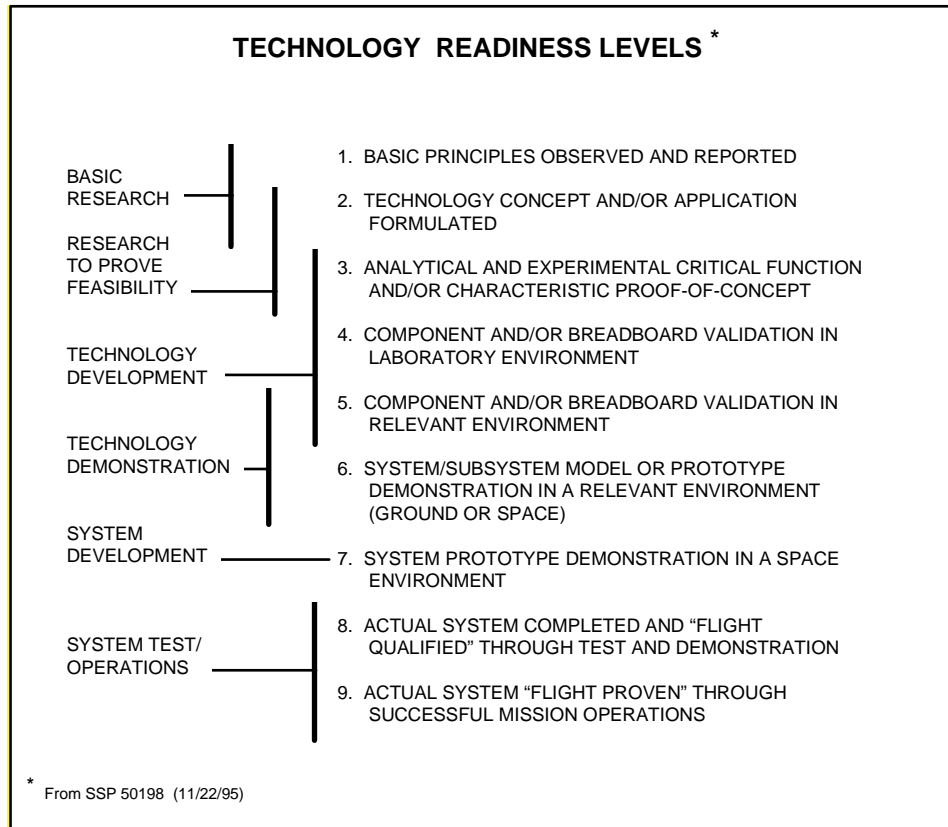


Figure 1. NASA Technology Readiness Levels

III. NSCORT Requirements and Areas of Emphasis

A. General Requirements

The ALS Advanced Life Support NSCORT must be proposed as a single U.S. entity but may be composed of more than one institution. The proposed NSCORT is strongly encouraged to include as a partner a Historically Black College or University (HBCU), a Hispanic Serving Institution (HSI) and/or an Other Minority University (OMU). Part of the evaluation of the proposed NSCORT will be based on the potential impact of the NSCORT on underrepresented groups (see Section IV, A of this Appendix for complete evaluation criteria).

The NSCORT should consist of independent and interacting projects in basic and applied research with a cohesive research theme that is consistent with the areas of emphasis outlined in this NRA. Each of the interacting projects should be independent and must show individual scientific merit. However, the proposal must also demonstrate how the different individual projects interact with each other and how the complementary strengths of each project further the overarching goals of the NSCORT. In order to better understand NASA's existing efforts in the area of bioregenerative life support and to avoid duplication of effort of research conducted elsewhere, prospective teams are highly encouraged to refer to the Life Sciences Taskbook (http://research.hq.nasa.gov/code_u/nra/current/NRA-01-OBPR-04/index.html). Additional

information concerning the ALS project can be obtained through the following key personnel at NASA.

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B. Areas of Emphasis for the NSCORT

The research projects solicited through this NRA and proposed by the NSCORT must be for work to be conducted at lower TRL levels only (TRL 1~4) and must address the needs of a long duration mission, such as an extended stay Martian base. To gain an understanding of NASA's current planning for possible future planetary missions, proposers are strongly encouraged to refer to the NASA Reference Missions Document (JSC 39502, <http://advlifesupport.jsc.nasa.gov/>), with particular reference to the Evolved Mars Base Mission. This document describes in detail the different exploration class missions that NASA has under consideration. The requirements and constraints of such missions on life support systems are detailed in the Advanced Life Support Systems Integration Modeling and Analysis (SIMA) Project Baseline Values and Assumptions Document (BVAD, JSC 39317), and should be also be taken into account for developing the proposal. The BVAD can be found at: <http://advlifesupport.jsc.nasa.gov/>

Long-duration missions, such as 1000-day class missions to the Moon or Mars, will require food systems that will likely include onsite food production and food processing capability as well as resource recovery from solid wastes (human wastes and inedible plant biomass). This requirement will increase as mission duration and distance from Earth increase. The logistics and costs associated with transport of life support consumables on these missions will cause resupply to become increasingly difficult and less frequent. Thus, the ability to reliably produce safe and nutritious food from crop plants and to recover resources from solid wastes will be essential.

Proposals for the Advanced Life Support NSCORT must focus primarily on basic and applied research in the areas described below. The proposed research must be consistent with NASA's plans for long duration space missions and, where possible, also be relevant to NASA's low-earth orbit research platforms, i.e., the International Space Station (ISS) and the Shuttle. The following sections describe the research areas that must be addressed by the Advanced Life Support NSCORT and also the give the relative effort that should be devoted to each area in terms of resources allocated.

Solid Waste Processing and Resource Recovery, Water Recovery and Air Revitalization (50%)

The focus of the solid waste processing effort should be on the recovery of useful resources on a planetary base for biomass production and on the optimization of systems that are able to process wastes at an accelerated rate, while at the same time increasing crew safety, system reliability, and reducing the mass, power, volume and crew time required by the system.

System requirements for long duration missions are focused primarily on resource recovery from solid waste to support biomass production. Bioregenerative systems can accomplish this recovery with tremendous savings of mass and power compared to physicochemical systems, although biological systems are inherently somewhat slower than physicochemical systems in terms of their transformation rates. Thus, the critical need for long duration missions will be to optimize bioregenerative systems that can recover essential resources from solid waste.

Proposers should be aware of the nature of the wastes likely to be generated during a long duration space mission. Because the relative amounts and kinds of plant and human waste material will play an important role in the optimization and selection of different waste treatment options, proposers should include waste characterization activities in their proposal.

To gain an understanding of the requirements and constraints of long duration missions to other planetary surfaces, proposers are required to develop their proposal in accordance to the ALS SIMA Baseline Values and Assumptions Document (BVAD).

The BVAD is a living document that will change as a result of the ongoing research being done by the ALS Program, including what is learned by the Advanced Life Support NSCORT. Therefore, it is expected that the successful proposal for the NSCORT will include specific plans for incorporating the results of its research into periodic updates of the BVAD (and other appropriate ALS documents, such as the ALS/AEMC Technology assessment matrix).

Although the primary focus of the NSCORT will be on research and technology development for solid waste processing systems consistent with planetary surface missions, efforts that are directed to more near term requirements for solid waste processing on shuttle and ISS are appropriate so long as they are also ultimately relevant to NASA's longer term exploration goals. Near term efforts should address issues such as water recovery, stabilization of wastes and reduction of associated risks (production of gaseous products, microbial contamination, etc.).

Production of Useful Products

Crop production systems inevitably produce a certain fraction of inedible biomass that, due to its composition, is difficult to recycle using biological methods. Using such wastes to manufacture necessary and useful products *in situ* could be a significant benefit to the mission and should be addressed in the proposal.

For example, some crops contain a significant amount of lignocellulosic wastes that are not easily amenable to biodegradation but could be used as materials for making useful products such as toilet paper, packaging material, or plant support structures.

Water Recovery

Liquid waste processing and water recovery research efforts should include optimization of biological reactors that treat anticipated wastes in a long duration mission. The input to the wastewater processing systems should include hygiene water, urine, and wastewater from food processing units and cleaning operations. The optimization of the reactors should emphasize a reduction of system mass, power, and volume, with minimal human intervention. Design and development of reactors should be based on process kinetics and compatibility with a microgravity or partial gravity environment.

Air Revitalization

Air revitalization research should focus on biological systems treating contaminated gaseous waste streams. The research plan should take into account treatment of gaseous contaminants that are likely to be generated from solid and liquid waste processing systems and cabin air. The goal is to reduce the levels of these contaminants below the Spacecraft Maximum Allowable Concentration (SMAC values can be found at <http://www.jsc.nasa.gov/toxicology/SMACSDB.pdf>). Options should be explored to return the transformed treatment products to the biomass production system.

Post treatment of Waste Residues

In all waste treatment operations, the generation of residues (stable organic material) is unavoidable. The fate and ultimate use of these residues is an issue that requires attention. As these residues are a reservoir of plant growth nutrients, extraction of nutrients to support plant growth should be considered. Moreover, understanding the impact of any one subsystem (e.g., solid waste processing) on other subsystems (e.g., air revitalization and water recovery) is also critical. Provisions for safe storage of unprocessed residuals is critical to ensure that there are no deleterious effects to crew health or planetary protection.

Biomass Production, Food Processing and Food Safety for Long Duration Missions (20%)

On early exploration missions, stored food items likely will be supplemented by food derived from biomass production systems both onboard the transit vehicle and on the planetary surface, (although such systems on the transit vehicle likely will be relatively small in scale and provide only fresh vegetables that require minimal processing by the crew). On the planetary surface, biomass production systems likely will evolve both in complexity and capacity as infrastructure is accumulated at a given site. Eventually, as mission length increases, economics will dictate that in-situ biomass production become the primary source of all food for long-duration crews.

Biomass Production

Efforts in biomass production should focus on cultivation and genetic improvement of crop plants that increase the ability of ALS to meet its goals of minimization of system mass, power, volume, and crew time required to care for crops. The kinds of crop plant modifications (for specific ALS candidate crops, see

<http://advlifesupport.jsc.nasa.gov/baselinecrops.html>)

that could be investigated include: improved photosynthetic efficiency; shorter life cycle; higher yield; improved nutritional value; more efficient use of limited volume (e.g., high-yielding dwarf cultivars); and reduced partitioning to structure (e.g., decreased lignin content). Effort also should be given to determining the efficacy of using extracted nutrients from the waste processing subsystem on plant growth and the efficacy of using of plants from the biomass production subsystem to serve as a feed component to the waste processing subsystem.

Food Processing and Food Safety

Development of a food processing and storage system for use on another planetary surface presents unique challenges to the ALS system. The system must be able to produce food that is palatable, nutritious, easily processed (using a minimum of crew time), stable for storage, and safe for consumption. Additionally, variations in crop quality, crop yield, and nutrient content may occur over the course of long duration missions, posing further requirements to the food processing and storage system. Such variations might affect the shelf stability and functional properties of the bulk ingredients and ultimately the quality of the final food products.

Efforts in food processing, food storage and food safety should focus on the development of technologies that satisfy mission constraints, including food stability, safety, and acceptability while reducing crew time, storage volume, power, and water usage. In addition, it is essential that the inputs (from biomass production subsystem) to the food processing subsystem and outputs from it (to solid waste processing subsystem) are well coordinated and integrated with those groups.

Assurance of food quality and food safety are essential components in the maintenance of crew health and well-being. Food quality and safety efforts should be focused on monitoring the shelf stability of processed food ingredients, on identification and control of microbial agents of food spoilage, including the development of countermeasures to ameliorate their effects. For all food production and processing procedures, HACCP (Hazard Analysis Critical Control Points) must be established.

Systems Analysis and Integration with ALS (20%)

The ALS Systems Integration and Modeling Analysis (SIMA) group is responsible for developing and updating the BVAD and the Reference Missions Document. Researchers from the NSCORT will be expected become involved with the SIMA group and to provide inputs for periodic updates of these documents. The NSCORT systems modeling effort also should provide a platform for establishing and fostering systems-level questions in the ALS project.

Within the NSCORT, integration of the efforts of groups working on different ALS subsystems (e.g., biomass production, food processing, waste processing) is critical to the development of a fully functional bioregenerative life support system. To fully understand the unique capabilities of bioregenerative subsystems, and to be able to fully integrate these subsystems with existing or emerging physical/chemical subsystems, a coherent systems analysis effort is essential.

For example, the relationship between the solid, liquid and gaseous waste processing subsystems needs to be defined. The input to any one of these subsystems often will be the untreated residues and waste products from other subsystems. The NSCORT is expected to play a central role in the development a working model for a fully integrated bioregenerative life support system.

Because biological systems require human involvement and intervention, the amount of crew time consumed for unit operations must be factored into the systems analysis effort. Also, in order to understand the fate and transport of materials through systems, life cycle analysis of major components, accurate mass balances, and the use of power and any expendables should be undertaken.

Education and Outreach (10%)

The successful proposal for the Advanced Life Support NSCORT will include a comprehensive plan for education (within the NSCORT) and outreach to the general public and to underrepresented groups.

The plan must include information on programs, classes and research opportunities that promote understanding of NASA and ALS related science and technology for undergraduate, graduate, and postdoctoral (where applicable) education at all member institutions within the NSCORT. It also must include information concerning specific programs in education and outreach that will be created for or expanded by the activities of the NSCORT that target minority or underrepresented groups within the NASA community. In particular, programs that promote public understanding of food safety issues, especially among consumers from underrepresented groups, will be given highest priority.

C. Structure of the NSCORT

Interactions among Investigators, University Partners and NASA

Teaming arrangements among investigators and research groups at the same institution and between different institutions is required and must be clearly explained. Evidence of appropriate institutional approval from each institution must be included in the proposal. The sharing of resources and responsibilities between any HBCU/HSI/OMU member institution(s) and any non-HBCU/HSI/OMU member institution(s) must be explicitly stated in the proposal. Part of the evaluation of the proposed NSCORT will be based on the potential impact of the NSCORT on underrepresented groups (see Section IV, A of this Appendix for complete evaluation criteria).

Key Personnel

Each proposing team must have an NSCORT Director with demonstrated scientific and administrative leadership qualities. The proposal should contain a detailed and coherent management structure that is conducive to accomplishing the goals of the NSCORT and is consistent with the research goals of the ALS Program. The positions of NSCORT Director, Associate Director(s) (if any) and Research Leads (Principal Investigators) are considered Key Personnel. Their qualifications, roles and responsibilities must be clearly defined in the proposal and may not be substituted without NASA's approval. The expertise of the key personnel should match the areas of emphasis. The Director of the NSCORT will be considered as the primary point of contact between the NSCORT and NASA.

Advisory Committees

Internal Advisory Committee

The NSCORT must propose to establish an Internal Advisory Committee to assist and support the Director to ensure that:

- the internal activities of and external interactions of the NSCORT are coordinated;
- funds are allocated and used to properly fulfill the objectives of the NSCORT;
- advice on productivity and effectiveness of the NSCORT is provided to the Director; and
- appropriate interactions take place to assure information exchange and technology transfer among scientists, engineers, and administrators, and those in other public and private institutions deemed important to the effort

The members of the Internal Advisory Committee should include faculty with appropriate expertise from all the participating institutions. The composition of this committee is at the discretion of the Director.

External Advisory Committee

In consultation with NASA, the NSCORT must also appoint an External Advisory Committee composed of nationally recognized experts familiar with the areas of study identified in this announcement to monitor the progress of the NSCORT with respect to the originally stated goals. The External Advisory Committee must provide the NSCORT with an annual written evaluation and critique.

Expertise of Universities

Academic Departments

The different academic departments at the participating institutions must have committed personnel and facilities to accommodate the research needs of this NSCORT. There should be a plan for coordination of research activities and resource sharing.

Personnel

The participating institutions must have faculty that has the expertise to undertake this multidisciplinary NSCORT project. The proposal should outline how the complementary expertise of the faculty will result in a teaming effort that will adequately address the research needs of the NSCORT.

Roles and Responsibilities

In order to achieve the research goals of the NSCORT, the roles and responsibilities of the individual investigators, Research Leads, Associate Director(s) and the Director must be clearly defined. The proposal must also include a description of these roles and responsibilities and interactions between partnering institutions. A description of the process for the transfer of resources and other partnering agreements between the participating institutions must be included in the proposal.

IV. Proposal Evaluation and Awards Selection Process

A. Responsiveness to the NRA

All proposals must respond to the requirements of the Announcement. Upon receipt, proposals will be reviewed for responsiveness to the requirements of this Announcement. This includes:

- Submission of complete proposals on or before the due date specified in this Announcement (see section V.F. of this Appendix);
- Responsiveness to the general requirements and specific emphases as described in this Announcement;
- Submission of a complete proposal, including a project description that does not exceed 40 pages in length (see Instructions, Appendix B);
- Submission of appropriate Institutional Review Board (IRB) or Animal Care and Use Committee (ACUC) certification for all proposals using human or animal test subjects (see Instructions, Appendix B);
- Submission of a budget that is within the guidelines specified in this Announcement and is for a funding period not to exceed five years in duration; and
- Submission of all other appropriate forms as required by this NASA Research Announcement (refer to Checklist for Investigators, Form H, Appendix B)

Note: At NASA's discretion, non-responsive proposals may be withdrawn from the review process and returned to the investigator without further review.

B. Overall Evaluation Process

The overall evaluation process for proposals submitted in response to this Announcement will include the following reviews:

- **Merit Review:** A review for intrinsic technical or scientific merit and overall impact will be conducted for all proposals.

*Those proposals receiving the highest rating in the **merit review** process will undergo the following additional reviews:*

- **Review for Relevance and Cost:** Relevance to NASA and proposed project cost; and
- **Site Visit Review:** Review of facilities and all facets of the technical review.

C. Merit Review

*A **merit** evaluation will be conducted for all proposals that are accepted by NASA for review (see Responsiveness to the NRA, section IV.A., this Appendix).*

The merit evaluation of proposals will be conducted by a panel of experts from academia, industry and NASA. The number and diversity of experts required will be determined by the response to this NRA. The merit review panel will assign *a score from 0-1000* or will designate the proposal as “not recommended for further consideration” based upon the intrinsic scientific or technical merit of the proposal. This score will reflect the consensus of the panel.

The score assigned by this panel will neither be affected by the cost of the proposed work nor will it reflect the programmatic relevance (meaning the relative priority of the proposed work to NASA). However, the panel will be asked to include in their critique of each proposal any comments they may have concerning the proposal’s budget and relevance to NASA.

Reviewers will be asked to consider the following criteria for each proposal. They are instructed to address and consider each of these criteria in assigning the overall score and also to assess whether excellence is demonstrated in *all* criteria (general merit review criteria above and broad impacts of the NSCORT).

Merit Review Criteria

The following criteria will be used to judge the proposal as a whole and each of the projects with in the proposal.

- **Approach: (0-200):** Are the proposed component projects adequately developed, well defined, well integrated, and appropriate to the aims of the NSCORT? Is the proposed approach likely to yield the desired results? Does the proposal acknowledge potential problem areas and consider alternative tactics? Is it likely that the proposed implementation timeline will be met?
- **Key Personnel and Investigators (0-100):** Do the qualifications, experience and proposed commitment of the proposed Director, Associate Director(s) and Research Leads reflect the scientific knowledge and effective leadership potential that will result in a successful NSCORT?

- **Environment (0-100):** How does the overall environment in which the work of the NSCORT will be performed contribute to the probability of success? Are the proposed facilities and equipment to be used adequate to achieve the goals of the NSCORT?
- **Collaboration and Overall Impact (0-100):** Will the proposed NSCORT foster effective collaborations between the investigators within the NSCORT? Is the research, educational, and knowledge transfer activities strategically integrated such that the whole is greater than the sum of the parts? Are all partners vital participants in the NSCORT effort?
- **Integration with NASA and ALS (0-100):** Is the proposed NSCORT likely to be well integrated with the overall ALS Program and with other NASA Centers and individual investigators who are doing similar work?
- **Internal and External Assessment (0-100):** Does the proposed NSCORT have an adequate plan to evaluate itself both internally and externally in order to ensure that it will be able to meet the goals established by NASA?
- **Advancement of Underrepresented Groups (0-100):** How well does the NSCORT broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.) in undergraduate and graduate education and in postdoctoral training? Is the participation of the HBCU/HSI/OMU partner(s) an integral part of the proposal based on the capability and relevant expertise of the HBCU/HSI/OMU institution(s) involved?
- **Education and Outreach Plan (0-200):** Does the proposed NSCORT have an adequate plan to broadly disseminate results that will enhance public understanding of science and technology and to increase public awareness of the goals of NASA and ALS, especially among underrepresented groups? Will the results of food safety research be shared with underrepresented groups in a manner that has the greatest possible impact and benefit to those groups?

D. Evaluation of Programmatic Relevance and Cost

*This review will be conducted only for those proposals receiving an **intrinsic merit** review score of 650 or higher.*

The evaluation of programmatic relevance and cost of each proposal will be conducted by NASA program scientists and managers as follows:

- **Programmatic Relevance:** The contributions of the proposed NSCORT toward attaining the goals of the overall mission of NASA.
- **Cost:** Evaluation of the proposed cost includes consideration of the realism and reasonableness of the proposed cost and the relationship of the proposed cost to available funds.

Site Visit

*This review will be conducted only for those proposals receiving an **intrinsic merit** review score of 650 or higher.*

This site visit phase will involve a review of all aspects of the proposal with special emphases on the facilities review. The proposing institutions should be prepared to supply the panel with additional information, if requested.

E. Development of Evaluation Findings

Information resulting from these reviews will be used by NASA program scientists and managers to prepare evaluation findings for the NSCORT. This recommendation will be based on:

1. the score for merit from the peer review panel (all proposals);
2. the programmatic relevance and cost of each proposal (when conducted); and
3. the findings of the site visit panel (when conducted).

The findings of these evaluations will be presented by NASA program scientists and managers to the Director of the Bioastronautics Research Division, who will make the selection for funding.

V. Program Management Information

A. Type of Award to be Made

The mechanism for funding the NSCORT will be a grant. The NSCORT will be funded by NASA one year at a time. The funding is to last for a maximum of five years and the total of indirect and direct costs is expected to be \$2.0 million/year. The NSCORT Director is expected to work closely with the appropriate technical representatives from NASA in order to assure continued success and programmatic relevance. At the end of the third year, NASA Bioastronautics Research Division will conduct a mid-term progress review to evaluate the success of the NSCORT program.

Role of NASA Field Centers

Johnson Space Center (JSC) is the NASA Field Center with primary programmatic responsibility for this NSCORT and will have the primary role in management oversight of the NSCORT. The Advanced Life Support Project at JSC will be responsible, along with Bioastronautics Research Division at NASA Headquarters, for annual evaluation of the progress of the NSCORT and its future plans.

Integration with other NASA ALS efforts

A measure of success of the NSCORT will be how well the research conducted there becomes integrated with ongoing NASA efforts in all areas of bioregenerative and physicochemical life support research and technology development. Since all parts of the overall ALS project must ultimately be integrated into a single functioning whole, the Advanced Life Support NSCORT must be fully aware of how its efforts fit into the overall ALS effort. This will include

participation in overall ALS strategic planning and communication cooperation with appropriate investigators at NASA centers and other institutions.

B. Eligibility

All categories of U.S. institutions are eligible to submit proposals in response to this NRA. Principal Investigators may collaborate with universities, Federal Government laboratories, the private sector, and state and local government laboratories. In all such arrangements, the applying entity is expected to be responsible for administering the project according to the management approach presented in the proposal.

The applying entity must have in place a documented base of ongoing high quality research in science and technology, or in those areas of science and engineering clearly relevant to the specific programmatic objectives and research emphases indicated in this Announcement. Present or prior support by NASA of research or training in any institution or for any investigator is not a prerequisite to submission of a proposal or a competing factor in the selection process.

C. Program Reporting/Individual Researcher Reporting

The proposal must indicate how the NSCORT will maintain awareness of NASA's needs in the technical areas described in this announcement and maintain communication with the appropriate points of contact at NASA, which are listed in section III of this Appendix.

As a vital measure of productivity, results from NSCORT research should be submitted to peer-reviewed journals as the work progresses. Only those published papers that acknowledge NASA's support and identify the NSCORT grant as a funding source will be counted as resulting from the NSCORT and be used to evaluate its productivity.

NSCORT Annual Report

The NSCORT will be expected to provide the Division Director, Bioastronautics Research Division, NASA Headquarters with annual summary information. This information will be provided one month prior to the end of the fiscal year and must consist primarily of:

- an abstract;
- a bibliographic list of publications;
- copies of publications; and
- a statement of progress, including a comparison with the originally proposed work schedule.

The yearly report must include information for each research project undertaken by the NSCORT. Additionally, the annual report must also include the following information for the entire NSCORT (encompassing all projects):

- a report on interactions and collaborations with groups outside the NSCORT;
- a report on the NSCORT education and outreach activities;

- a plan for the next 12 months; and
- status information on the NSCORT's management and financial condition, projects (completed and in-progress) and partnerships.

This information will be made available to the scientific community and will be used to assess the strength of the Biological Research Division's programs. It will also serve as the basis for determining the degree of progress of the project.

Individual Researcher Annual Task Book Reporting

The Life Sciences Program Tasks and Bibliography (Life Sciences Task Book) is published annually by the Office of Biological and Physical Research. The Task Book includes descriptions of all peer-reviewed activities funded by the Biological Research Division during the previous fiscal year. The Task Book is an invaluable source of information for NASA biological and biomedical researchers as well as the external scientific and technical communities. In addition to the annual program reporting by the NSCORT, all individual Research Leads are required to submit an annual report for inclusion in the Life Sciences Task Book.

The NSCORT Research Leads (Principal Investigators) must provide information for this publication on an annual basis. Please note that this requirement is in addition to the annual report, which the NSCORT is required to submit at the end of each funding cycle. Supplying the requested information for the Life Sciences Task Book does NOT fulfill the requirement for the annual report. Unlike the annual report, information requested for the Task Book must be for the Government's fiscal year rather than the project funding cycle and brief.

The information that must be included in the report for the Task Book consists primarily of:

- an abstract;
- a brief statement of progress during the fiscal year;
- a brief statement of benefits of the research with respect to life on Earth;
- a bibliographic list for the fiscal year;
- a copy or reprint of each publication listed in the bibliography for the fiscal year;
- a listing of presentations or activities conducted at K-12 educational institutions; and
- a listing of interactions, presentations, or other activities with the general public.

Please note that each individual research project undertaken at the NSCORT needs to comply with the Task Book requirement. Also note that although this publication will be made available to the general scientific community, it is not a substitute for traditional scientific reporting in journals and elsewhere.

Final Report

A final report must be provided to the Division Director, Biological Research Division, NASA HQ at the end of the five-year funding period, including a detailed listing of all peer-reviewed publications. Information required for inclusion in final reports is:

- summary of the NSCORT research activities;
- statement of the specific objectives;
- significance of the work;
- background;
- overall progress during the performance period;
- narrative discussion of technical approaches including problems encountered;
- accomplishments related to approach; and
- an appendix with bibliography and copies of all publications and reports. Any publications or other public materials containing data are particularly important to include in this section.

D. Other Considerations

Required Travel

The proposal must include travel funds for the following:

- Annual Principal Investigators meeting
- Annual ALS Strategic Planning meeting

Optional Travel

- Visits to NASA Field Centers
- Presentation at a professional society meeting (highly desirable)

E. Notice of Intent and Proposal Submission Information

Notices of Intent

To facilitate proposal processing, investigators are requested to confirm plans to submit a proposal responding to this Announcement by sending a notice of intent (NOI) to propose. ***The NOI, which is not binding, should be submitted electronically by August 16, 2001 by 4:30 PM EDT.*** If you do not have access to electronic submission, you may submit the NOI via U.S. Postal Service or by commercial delivery. The NOI, which should not be more than four pages in length, should contain:

- The name, postal address, telephone number and email address of a single point of contact
- Names and affiliations of all investigators and co-investigators
- A descriptive title of the proposed research and technical activities of the NSCORT
- A brief yet thorough summary describing the proposed NSCORT research activities (not to exceed 500 words)
- The major participating institutions
- Up to six key words that best describe the research areas of the pending proposal

F. Proposal Schedule

The following schedule is planned for the NSCORT under this Announcement:

Notice of Intent to Propose Due	August 16, 2001
Proposal Due	October 16, 2001
Selection Announcement	January 2001
Initial Funding Available	February 2002

VI. Bibliography

NASA Top Level Strategic Plans and Reviews:

- **National Aeronautics and Space Administration Strategic Plan. (2000).** NASA, Washington, DC. <http://www.hq.nasa.gov/office/codez/plans/pl2000.pdf>
- **NASA's Enterprise for the Human Exploration and Development of Space: The Strategic Plan. (2000).** NASA, Washington, DC. <http://www.plans.nasa.gov>
- **Advanced Technology for Human Support in Space. (1997).** Report of the National Research Council (NRC) Committee on Advanced Technology for Human Support in Space, Aeronautics and Space Engineering Board (ASEB), National Academy Press, Washington DC (ISBN 0-309-05744-2; 1997) <http://www.nap.edu/books/0309057442/html/10.html>
- **Assessment of Programs in Space Biology and Medicine. (1991)** National Academy of Sciences, National Research Council. Committee on Space Biology and Medicine, National Academy Press, Washington, DC (*NTIS #N9313327 - \$19.50*).

NASA AHST Discipline Science/Technology Plans and Requirements Documents produced by the projects within the Advanced Human Support Technologies Program in the Bioastronautics Research Division, NASA, Washington, DC:

- **Advanced Human Support Technologies Program Plan (1999)**
- **Advanced EVA Exploration Requirements (JSC 2000)**
- **Advanced Life Support Project Plan (1999)**
- **Advanced Life Support Program Requirements (1998)**

NASA AHST Discipline Roadmaps produced by the projects within the Advanced Human Support Technologies Program in the Bioastronautics Research Division, NASA, Washington, DC:

- **ALS Roadmap (1998)**
Available at: <http://advlifesupport.jsc.nasa.gov/>

NASA Cumulative Bibliographies: publications resulting from research supported by the Bioastronautics Research Division:

- **Publications of the NASA Controlled Ecological Life Support System (CELSS) Program: 1989-1992.** (1994) J.V. Powers (Ed.). NASA Contractor Report 4603. (NTIS #N9430122 - \$17.50).

NASA Strategic Planning Documents: publications resulting from activities supporting the development of strategic plans and research strategies:

- **A Strategy for Space Biology and Medical Science into the Next Century. (1998).** National Academy of Sciences, National Research Council, Committee on Space Biology and Medicine; Jay M. Goldberg, Committee Chairperson; National Academy Press, Washington, DC <http://books.nap.edu/books/0309060478/html/index.html>
- **Exploring the Living Universe: A Strategy for Space Life Sciences. (1988).** National Aeronautics and Space Administration Advisory Council. Life Sciences Strategic Planning Study Committee; Frederick C. Robbins, Committee Chairperson; National Aeronautics and Space Administration, Washington, DC.
- **Space Biology and Medicine: Volume II, Life Support and Habitability. (1994).** F.M. Sulzman and A.M. Genin (Eds.), American Institute of Aeronautics and Astronautics, Washington, DC.
- **Space Physiology and Medicine, 3rd ed. (1994).** A. Nicogossian, C. Huntoon, and S. Pool (Eds.) PA: Lea & Febiger, Philadelphia.
- **Strategic Considerations for Support of Humans in Space and Moon/Mars Exploration Missions. (1992).** National Aeronautics and Space Administration Advisory Council, Aerospace Medicine Advisory Council, National Aeronautics and Space Administration, Washington, DC.

Databases:

- **Spaceline.** An online bibliographic database is available for searching for references to publications about space biological sciences research.
Phone: (301) 295-2482 Email: SPACELINE@mx3.usuhs.mil
<http://spaceline.usuhs.mil/> <http://igm.nlm.nih.gov> (MEDLINE)
- **Life Sciences Task Book, FY 2000.** An online searchable database of projects funded by the Bioastronautics and Fundamental Space Biology Divisions.
http://research.hq.nasa.gov/code_u/nra/current/NRA-01-OBPR-04/index.html

Other Documents: Relevant research papers, review papers, conference reports and engineering documentation

- **Elements of Spacecraft Cabin Air Quality Control Design (1998),** J.L. Perry, NASA TP-1998-207978
- **Expert Panel Review of Analytical Technologies Suitable for a Second-Generation Air Quality Instrument for the International Space Station (1998),** sponsored by the NASA/JSC Toxicology Group, JSC 28254, Lyndon B. Johnson Space Center, Houston, Texas.

**Instructions for Proposal Preparation
and
Required Application Forms**

This section contains the general instructions for proposal preparation and the specific forms required by investigators responding to this Announcement. **This section is specific to this NRA and supersedes the information contained in Appendix C.** The forms at the end of this section include the following:

Form A	Solicited Proposal Application
Form B	Proposal Abstract
Form D	Biographical Sketch
Form E	Other Support
Form F	Detailed Budget, First Year
Form G	Detailed Budget, Entire Project Period
Form H	Checklist for Investigators

Instructions for Proposal Preparation

Investigators are encouraged to print their proposals double-sided (except forms), single-spaced, in a 12-point text font (except forms), and on 8.5" × 11" plain white paper with at least one inch top, bottom, right and left margins. Also, proposals should be bound using only metal staples or metal binder clips.

All proposals must include each of the forms provided in this Appendix as part of the complete submission (see the form-specific instructions included in this Appendix). Please submit **15 printed copies** of the complete proposal plus one signed original.

The proposal must include the following material, in this order:

1. Cover Page: Solicited Proposal Application (Form A), including certification of compliance with U.S. code (if applicable)*
2. Proposal Abstract (Form B)
3. Proposal Title Page, with Notice on Restriction on Use and Disclosure of Proposal Information, if any
4. Statement of Justification
5. NSCORT Research Plan Description Preface (Renewal Proposals only)
6. NSCORT Research Plan Description
7. Management Approach
8. Biographical Sketch (Form D)
9. Other Support (Form E)
10. Facilities and Equipment
11. Special Matters (specific information on animal or human subjects protocol approval required, if applicable)*
12. Detailed Budget, 12 Month (Form F)
13. Detailed Budget, Entire Project Period (Form G)
14. Supporting Budgetary Information
15. Checklist for Investigators (Form H)
16. Appendices, if any
17. Computer diskette (3.5 inch, Macintosh or PC format) containing an electronic copy of the principal investigator's name, address, telephone and fax numbers, e-mail address, and the complete project title and abstract as provided on Form B

* One signed original required

The Project Description section is limited to 40 pages. Any page(s) in this section beyond 40 will not be reviewed. There is no specific page limitation on other sections of submitted proposals. However, every effort must be made to keep proposals as brief as possible. The name of the lead proposing institution must appear in the upper right hand corner of each page of the proposal, except on the forms in this Appendix where special places are provided for this information.

1. Cover Page: Solicited Proposal Application (Form A)

All of the information requested on Form A must be provided, and one original signature version of this form must be submitted. This form meets the requirements of the transmittal letter described in Appendix C, section (c)(1).

Note: Items (9) and (10) on Form A require assurance of compliance with human subject or animal care provisions of NASA regulations (see "Special Matters" section below). If IRB or ACUC review is unavoidably delayed beyond the submission of the application, enter "Pending"

on line 9b or 10b in Form A. Investigators should be aware that proposal review will not be undertaken without prior assurance of compliance.

2. Proposal Abstract (Form B)

The information that is requested on this form is essential for proposal review. It helps determine the responsiveness of the proposal to the solicitation and also enables the program manager(s) in the selection process.

3. Proposal Title Page

The Title Page must contain the title, name and address of the submitting institution(s), the name, address, and telephone number of the Director, and the names and institutions of any co-investigators. It is NASA policy to use information contained in proposals for evaluation purposes only. While this policy does not require that the proposal bear a restrictive notice, offerors or quoters should, in order to maximize protection of trade secrets or other information that is commercial or financial and confidential or privileged, place the following notice on the Title Page of the proposal and specify the information subject to the notice by inserting appropriate identification, such as page numbers, in the notice. In any event, information (data) contained in proposals will be protected to the extent permitted by law; however, NASA assumes no liability for use and disclosure of information not made subject to the notice.

NOTICE

Restriction on Use and Disclosure of Proposal Information

The information (data) contained in [insert page numbers or other identification] of this proposal constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract (or other agreement) is awarded on the basis of this proposal the Government shall have the right to use and disclose this information (data) to the extent provided in the contract (or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

4. Statement of Justification

The one page justification must include a discussion on how the proposed research satisfies the unique requirements of the ALS project. In developing the justification, the investigator should refer to the relevant AHST/ALS Program documents listed in Bibliography (Appendix A, section VI) and identify how the proposed research plan would address issues such as systems integration, risk mitigation or reduction in the equivalent system mass.

5. NSCORT Description Preface (Renewal proposals only)

Proposals from previously funded institutions soliciting continued funding must include a preface to the NSCORT description. This preface must not exceed three pages in length and must clearly state how these Institutions will build on previous funding and results achieved thus so far. The pages in the preface will not count toward the 40-page limit of the project description.

6. NSCORT Research Plan Description

The length of the NSCORT Research Plan Description section of the proposal must not exceed 40 pages using regular (12 point) font type and left, right, top and bottom margins of one inch. **Pages beyond the 40-page limit will not be reviewed.** The research plan must contain sufficient detail to enable reviewers to make informed judgments about the overall merit of the proposed research and about the probability that the NSCORT investigators will be able to accomplish the stated objectives with the resources provided for the NSCORT. In addition, the proposal must clearly indicate the relationship between the proposed work and the research emphases defined in this Announcement.

7. Management Approach

Each proposal must specify a single Point of Contact (Director) who is responsible for carrying out the proposed NSCORT and coordinating the work of other personnel involved in the NSCORT. The roles and responsibilities of the Associate Directors, Research Leads and other Key Personnel in the NSCORT and the proportion of each individual's time to be devoted to the proposed research activity must be clearly defined. The proposal must clearly and unambiguously state whether these key personnel have reviewed the proposal and endorsed their participation.

8. Biographical Sketch (Form D)

The NSCORT Director is responsible for direct supervision of the work and must participate in the conduct of the research regardless of whether or not compensation is received under the award. A short biographical sketch of the Director that includes his or her current position title and educational background, a list of principal publications, and a description of any exceptional qualifications must be included. Use Form D to describe the research and professional experience of the Associate Director, Research Leads and other Key Personnel. Concluding with present position, chronologically list previous employment, experience, and honors. Include present membership on any Federal Government public advisory committee. List, in chronological order, the titles, all authors, and complete references to all publications during the past three years and to representative earlier publications pertinent to this application. If the list of publications in the last three years exceeds two pages, select the most pertinent publications. *Do not exceed two pages.* Omit social security numbers and other personal items that do not merit consideration in evaluation of the proposal. Provide similar biographical information on other senior professional personnel who will be directly associated with the project. Provide the names and titles of any other scientists and technical personnel associated substantially with the

project in an advisory capacity. Universities should list the approximate number of students or other assistants, with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

9. Other Support (Form E)

Use the format described in Form E to list other sources of research support for the proposal. Please include all active support (including active NASA support), as well as any pending support for the research personnel involved in the NSCORT.

10. Facilities and Equipment

Describe the available facilities and major items of equipment specially adapted or suited to the proposed research activities, and any additional major equipment that will be required. Identify any government-owned facilities, industrial plant equipment, or special tooling that are proposed for use in the research activities. The research plan must provide evidence that such facilities or equipment will be made available if the proposal is accepted. Before requesting a major item of capital equipment, the proposer should determine the availability of equipment already within the organization as an alternative to purchase. Where such arrangements cannot be made, the proposal should state this explicitly. The need for items that can be typically used for research and non-research purposes should be explained.

11. Special Matters

The Special Matters section must contain a statement from the investigator's institution(s) that states that the proposed work will meet all Federal and local human subject requirements and animal care and use requirements, if applicable. Note that no animal subjects may be utilized unless specific information justifying and describing their use is included in the proposal. Policies regarding the protection of human research subjects in NASA-sponsored research are detailed in NASA Management Instruction (NMI) 7100.8B (Protection of Human Research Subjects), and animal care and use requirements are detailed in the NASA Code of Federal Regulations (CFR) 1232 (Care and Use of Animals in the Conduct of NASA Activities), both of which are available from the Office of Biological and Physical Research, NASA Headquarters, Washington, DC 20546. Assurance of compliance with human subject or animal care provisions is required on Form A to be submitted with each proposal. In addition, a letter signed by the chairperson of the Institutional Review Board (IRB), institutional Animal Care and Use Committee (ACUC), or both, as appropriate, regarding approval of the experimental protocol, must be included with each copy of the proposal. If IRB or ACUC review is unavoidably delayed beyond the submission of the application, the certification must be received within 60 days after the due date for which the application is submitted. *If certification is not received within 60 days after the application due date, the application will be considered incomplete.* NASA requires current IRB or ACUC certification prior to award. All U.S., non-NASA proposals providing ACUC approval must also contain the institution's Public Health Assurance number.

12. Detailed Budget, 12 Month (Form F) and (13) Detailed Budget, Entire Project Period (Form G)

These forms must be submitted with each proposal.

14. Supporting Budgetary Information

This section must include information that supports the costs submitted in Forms F and G. In this solicitation, the terms “cost” and “budget” are used synonymously. Sufficient proposal cost detail and supporting information are required; funding amounts proposed with no explanation (e.g., Equipment: \$1,000 or Labor: \$6,000) may cause delays in evaluation and award. Generally, costs will be evaluated as to realism, reasonableness, allowability, and allocation. The budgetary forms define the desired detail, but each category should be explained in this section. Offerors should exercise prudent judgment in determining what to include in the proposal, as the amount of detail necessarily varies with the complexity of the proposal.

The following indicate the suggested method of preparing a cost breakdown:

Direct Labor

Labor costs must be segregated by titles or disciplines with estimated hours and rates for each. Estimates must include a basis of estimate such as currently paid rates or outstanding offers to prospective employees. This format allows the Government to assess cost reasonableness by various means including comparison to similar skills at other organizations.

Other Direct Costs

Please detail, explain, and substantiate other significant cost categories as described below:

- a) Subcontracts: Describe the work to be contracted, estimated amount, recipient (if known), and the reason for subcontracting.
- b) Consultants: Identify consultants to be used, why they are necessary, the time they will spend on the NSCORT activities, and the rates of pay (not to exceed the equivalent of the daily rate for Level IV of the Executive Schedule, exclusive of expenses and indirect costs).
- c) Equipment: List separately. Explain the need for items costing more than \$5,000. Describe basis for estimated cost. General purpose equipment is not allowable as a direct cost unless specifically approved by the NASA Grant Officer. Any equipment purchase requested as a direct charge must include the equipment description, how it will be used in the conduct of the basic research proposed, and why it cannot be purchased with indirect funds.
- d) Supplies: Provide general categories of needed supplies, the method of acquisition, and estimated cost.
- e) Travel: Describe the purpose of the proposed travel in relation to the grant and provide the basis of estimate, including information on destination and number of travelers where known.
- f) Other: Enter the total of direct costs not covered by (a) through (e). Attach an itemized list explaining the need for each item and the basis for the estimate.

Indirect Costs

Indirect costs must be explained to an extent that will allow the Government to understand the basis for the estimate. Examples of prior year historical rates, current variances from those rates, or an explanation of other basis of estimates must be included. Where costs are based on allocation percentages or dollar rates, an explanation of rate and application base relationships should be given. For example, the base to which the General and Administrative (G&A) rate is applied could be explained as: application base equals total costs before G&A less subcontracts.

15. Checklist for Investigators (Form H)

One copy of a completed version of this checklist should be attached to Form A of the original proposal.

16. Appendices, if any

Appendices may be included, but investigators should be aware that reviewers are not required to consider information presented in appendices.

17. Computer Diskette

A diskette (3.5-inch, Macintosh or PC format) must contain an electronic copy of the NSCORT Point of Contact's name, address, telephone and fax numbers, email address, and the complete project title and abstract as provided on Form B.

The Required Application Forms

must be accessed separately at

http://research.hq.nasa.gov/code_u/nra/current/NRA-01-OBPR-04/index.html

**INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH
ANNOUNCEMENTS**

(JANUARY 2000)

(a) General.

(1) Proposals received in response to a NASA Research Announcement (NRA) will be used only for evaluation purposes. NASA does not allow a proposal, the contents of which are not available without restriction from another source, or any unique ideas submitted in response to an NRA to be used as the basis of a solicitation or in negotiation with other organizations, nor is a pre-award synopsis published for individual proposals.

(2) A solicited proposal that results in a NASA award becomes part of the record of that transaction and may be available to the public on specific request; however, information or material that NASA and the awardee mutually agree to be of a privileged nature will be held in confidence to the extent permitted by law, including the Freedom of Information Act.

(3) NRAs contain programmatic information and certain requirements which apply only to proposals prepared in response to that particular announcement. These instructions contain the general proposal preparation information which applies to responses to all NRAs.

(4) A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded in response to an NRA. NASA will determine the appropriate instrument. Contracts resulting from NRAs are subject to the Federal Acquisition Regulation and the NASA FAR Supplement. Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPG 5800.1).

(5) NASA does not have mandatory forms or formats for responses to NRAs; however, it is requested that proposals conform to the guidelines in these instructions. NASA may accept proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the investigators' most favorable terms.

(6) To be considered for award, a submission must, at a minimum, present a specific project within the areas delineated by the NRA; contain sufficient technical and cost information to permit a meaningful evaluation; be signed by an official authorized to legally bind the submitting organization; not merely offer to perform standard services or to just provide computer facilities or services; and not significantly duplicate a more specific current or pending NASA solicitation.

(b) NRA-Specific Items. Several proposal submission items appear in the NRA itself: the unique NRA identifier; when to submit proposals; where to send proposals; number of copies required; and sources for more information. Items included in these instructions may be supplemented by the NRA.

(c) The following information is needed to permit consideration in an objective manner. NRAs will generally specify topics for which additional information or greater detail is desirable. Each proposal copy must contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

(1) Transmittal Letter or Prefatory Material.

(i) The legal name and address of the organization and specific division or campus identification if part of a larger organization;

(ii) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;

(iii) Type of organization: e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;

(iv) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;

(v) Identification of other organizations that are currently evaluating a proposal for the same efforts;

(vi) Identification of the NRA, by number and title, to which the proposal is responding;

(vii) Dollar amount requested, desired starting date, and duration of project;

(viii) Date of submission; and

(ix) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization (unless the signature appears on the proposal itself).

(2) Restriction on Use and Disclosure of Proposal Information. Information contained in proposals is used for evaluation purposes only. Offerors or quoters should, in order to maximize protection of trade secrets or other information that is confidential or privileged, place the following notice on the title page of the proposal and specify the information subject to the notice by inserting an appropriate identification in the notice. In any event, information contained in proposals will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

Notice

Restriction on Use and Disclosure of Proposal Information

The information (data) contained in [insert page numbers or other identification] of this proposal constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract (or other agreement) is awarded on the basis of this proposal the Government shall have the right to use and disclose this information (data) to the extent provided in the contract (or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

(3) Abstract. Include a concise (200-300 word if not otherwise specified in the NRA) abstract describing the objective and the method of approach.

(4) Project Description.

(i) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance; relation to the present state of knowledge; and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the plan of work, including the broad design of experiments to be undertaken and a description of experimental methods and procedures. The project description should address the evaluation factors in these instructions and any specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Subcontracting significant portions of a research project is discouraged.

(ii) When it is expected that the effort will require more than one year, the proposal should cover the complete project to the extent that it can be reasonably anticipated. Principal emphasis should be on the first year of work, and the description should distinguish clearly between the first year's work and work planned for subsequent years.

(5) Management Approach. For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and arrangements for ensuring a coordinated effort should be described.

(6) Personnel. The principal investigator is responsible for supervision of the work and participates in the conduct of the research regardless of whether or not compensated under the award. A short biographical sketch of the principal investigator, a list of principal publications and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the

proposal. Give similar biographical information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

(7) Facilities and Equipment.

(i) Describe available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any Government-owned facilities, industrial plant equipment, or special tooling that are proposed for use. Include evidence of its availability and the cognizant Government points of contact.

(ii) Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative. Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for research and non-research purposes should be explained.

(8) Proposed Costs (U.S. Proposals Only).

(i) Proposals should contain cost and technical parts in one volume: do not use separate "confidential" salary pages. As applicable, include separate cost estimates for salaries and wages; fringe benefits; equipment; expendable materials and supplies; services; domestic and foreign travel; ADP expenses; publication or page charges; consultants; subcontracts; other miscellaneous identifiable direct costs; and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and engineering professionals, graduate students, research assistants, and technicians and other non-professional personnel). Estimate all staffing data in terms of staff-months or fractions of full-time.

(ii) Explanatory notes should accompany the cost proposal to provide identification and estimated cost of major capital equipment items to be acquired; purpose and estimated number and lengths of trips planned; basis for indirect cost computation (including date of most recent negotiation and cognizant agency); and clarification of other items in the cost proposal that are not self-evident. List estimated expenses as yearly requirements by major work phases.

(iii) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 1831 (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations).

(iv) Use of NASA funds--NASA funding may not be used for foreign research efforts at any level, whether as a collaborator or a subcontract. The direct purchase of

supplies and/or services, which do not constitute research, from non-U.S. sources by U.S. award recipients is permitted. Additionally, in accordance with the National Space Transportation Policy, use of a non-U.S. manufactured launch vehicle is permitted only on a no-exchange-of-funds basis.

(9) Security. Proposals should not contain security classified material. If the research requires access to or may generate security classified information, the submitter will be required to comply with Government security regulations.

(10) Current Support. For other current projects being conducted by the principal investigator, provide title of project, sponsoring agency, and ending date.

(11) Special Matters.

(i) Include any required statements of environmental impact of the research, human subject or animal care provisions, conflict of interest, or on such other topics as may be required by the nature of the effort and current statutes, executive orders, or other current Government-wide guidelines.

(ii) Investigators should include a brief description of the organization, its facilities, and previous work experience in the field of the proposal. Identify the cognizant Government audit agency, inspection agency, and administrative contracting officer, when applicable.

(d) Renewal Proposals.

(1) Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. A renewal proposal should not repeat all of the information that was in the original proposal. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of the research are expected to be covered during the period for which support is desired. A description of any significant findings since the most recent progress report should be included. The renewal proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.

(2) NASA may renew an effort either through amendment of an existing contract or by a new award.

(e) Length. Unless otherwise specified in the NRA, effort should be made to keep proposals as brief as possible, concentrating on substantive material. Few proposals need exceed 15-20 pages. Necessary detailed information, such as reprints, should be included as attachments. A complete set of attachments is necessary for each copy of the proposal. As proposals are not returned, avoid use of "one-of-a-kind" attachments.

(f) Joint Proposals.

(1) Where multiple organizations are involved, the proposal may be submitted by only one of them. It should clearly describe the role to be played by the other organizations and indicate the legal and managerial arrangements contemplated. In other instances, simultaneous submission of related proposals from each organization might be appropriate, in which case parallel awards would be made.

(2) Where a project of a cooperative nature with NASA is contemplated, describe the contributions expected from any participating NASA investigator and agency facilities or equipment which may be required. The proposal must be confined only to that which the proposing organization can commit itself. "Joint" proposals which specify the internal arrangements NASA will actually make are not acceptable as a means of establishing an agency commitment.

(g) Late Proposals. Proposals or proposal modifications received after the latest date specified for receipt may be considered if a significant reduction in cost to the Government is probable or if there are significant technical advantages, as compared with proposals previously received.

(h) Withdrawal. Proposals may be withdrawn by the proposer at any time before award. Offerors are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances which dictate termination of evaluation.

(i) Evaluation Factors.

(1) Unless otherwise specified in the NRA, the principal elements (of approximately equal weight) considered in evaluating a proposal are its relevance to NASA's objectives, intrinsic merit, and cost.

(2) Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to NASA's mission.

(3) Evaluation of its intrinsic merit includes the consideration of the following factors of equal importance:

(i) Overall scientific or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.

(ii) Offeror's capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.

(iii) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel critical in achieving the proposal objectives.

(iv) Overall standing among similar proposals and/or evaluation against the state-of-the-art.

(4) Evaluation of the cost of a proposed effort may include the realism and reasonableness of the proposed cost and available funds.

(j) Evaluation Techniques. Selection decisions will be made following peer and/or scientific review of the proposals. Several evaluation techniques are regularly used within NASA. In all cases proposals are subject to scientific review by discipline specialists in the area of the proposal. Some proposals are reviewed entirely in-house, others are evaluated by a combination of in-house and selected external reviewers, while yet others are subject to the full external peer review technique (with due regard for conflict-of-interest and protection of proposal information), such as by mail or through assembled panels. The final decisions are made by a NASA selecting official. A proposal which is scientifically and programmatically meritorious, but not selected for award during its initial review, may be included in subsequent reviews unless the proposer requests otherwise.

(k) Selection for Award.

(1) When a proposal is not selected for award, the proposer will be notified. NASA will explain generally why the proposal was not selected. Investigators desiring additional information may contact the selecting official who will arrange a debriefing.

(2) When a proposal is selected for award, negotiation and award will be handled by the procurement office in the funding installation. The proposal is used as the basis for negotiation. The contracting officer may request certain business data and may forward a model award instrument and other information pertinent to negotiation.

(l) Additional Guidelines Applicable to Foreign Proposals and Proposals Including Foreign Participation.

(1) NASA welcomes proposals from outside the U.S. However, foreign entities are generally not eligible for funding from NASA. Therefore, unless otherwise noted in the NRA, proposals from foreign entities should not include a cost plan unless the proposal involves collaboration with a U.S. institution, in which case a cost plan for only the participation of the U.S. entity must be included. Proposals from foreign entities and proposals from U.S. entities that include foreign participation must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the foreign entity is proposing. Such endorsement should indicate that the proposal merits careful consideration by NASA, and if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.

(2) All foreign proposals must be typewritten in English and comply with all other submission requirements stated in the NRA. All foreign proposals will undergo the same evaluation and selection process as those originating in the U.S. All proposals must be received before the established closing date. Those received after the closing date will be treated in accordance with paragraph (g) of this provision. Sponsoring foreign government agencies or funding institutions may, in exceptional situations, forward a proposal without endorsement if endorsement is not possible before the announced closing date. In such

cases, the NASA sponsoring office should be advised when a decision on endorsement can be expected.

(3) Successful and unsuccessful foreign entities will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the foreign sponsor. Should a foreign proposal or a U.S. proposal with foreign participation be selected, NASA's Office of External Relations will arrange with the foreign sponsor for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency or funding institution will each bear the cost of discharging their respective responsibilities.

(4) Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

(i) An exchange of letters between NASA and the foreign sponsor; or

(ii) A formal Agency-to-Agency Memorandum of Understanding (MOU).

(m) Cancellation of NRA. NASA reserves the right to make no awards under this NRA and to cancel this NRA. NASA assumes no liability for canceling the NRA or for anyone's failure to receive actual notice of cancellation.